

Attachment 17

Bay d'Espoir Unit 8 FEED Risk and Assumption Register

AtkinsRéalis



APPENDIX H. RISK REGISTER, AND ASSUMPTION REGISTER



The assumption register identifies, records and manages various assumptions made during the Bay d'Espoir Unit 8 FEED that may affect the project, such as technical, environmental, schedule, operational, risk and financial assumptions.

PROJECT No.
699257

NUH Doc No.
BDE-APR-00000-8(DSP-0002-01)

AR Doc No.
699257-3400-40AG-0001

Date
Dec 1 2024

Short Description	DESCRIPTION	Why Made?	Verifiable? (Yes, No, Uncertain)	Notes	Red Flag	Health Check	Added by	Date	Project Comments
1 Power Data	Ready for operation (in service and accepted) before November 2031.		Uncertain				NUH	2024-09-03	NUH Hydro has defined this target date for the Project Schedule.
2 Design Parameters such as rock mapping and shear strength	The literature review has been considered for this step. The data available from investigation reports, the shear strength of the rock mass, and the shear strength of the rock mass are not available. The shear strength of the rock mass cannot be determined by the core logs and is only available from laboratory tests such as direct shear test.		Yes	Additional geotechnical information required to assess this, include in next phase of design.			AR NF	11-03-2024	
3 Stability Assessment of New and Existing Excavations	The stability and excavation geometry assessment have been done based on similar experiences in the same rock and also based on the existing slopes.	This analysis has not been done as no information about shear strength of joints or Dip/Dip Direction of joints were not available in this phase.	Yes	Additional geotechnical information required to assess this, include in next phase of design.			AR NF	11-03-2025	
4 Rock Support Design	The support design for unstable blocks should be done based on empirical method and based on shear strength parameters and joint dip/dip direction of joints.	This analysis has not been done as no information about shear strength of joints or Dip/Dip Direction of joints were not available in this phase.	Yes	Additional geotechnical information required to assess this, include in next phase of design.			AR NF	11-03-2026	
5 Bedrock Depths	Bedrock depths in the vicinity of the headrace, intake, penstock and powerhouse have been assumed based on lidar, test pit, and borehole data, as well as 1977 as-built information, which have been provided by NU Hydro.	Available information is not all in current planned location of new construction, requiring assumptions and extrapolation.	Yes	Additional geotechnical information required to assess this, include in next phase of design.					
6 Existing powerhouse superstructure is adequate and does not require modification.	It is assumed that the structural integrity of the existing superstructure is adequate, and that the existing powerhouse does not require modifications. (Bay d'Espoir Hydro Generating Unit 8, Class 3 Cost Estimate and Project Execution Schedule, SUI Doc. No. 647756-000-40ER-4-002, Pg. 34).		Yes	Assess configuration of Unit 7 Structure to determine if modifications are necessary	2		NUH	2023-11-08	Assessment of Unit 7 existing structure will be performed as required during detailed design when the construction of Unit 8 facilities may impact the existing facility.
7 Unit 7 Bridge Crane can be used for Unit 8.	Use existing Unit 7 bridge crane and hoist for Unit 8. (Bay d'Espoir Hydro Generating Unit 8, Class 3 Cost Estimate and Project Execution Schedule, SUI Doc. No. 647756-000-40ER-4-002, Pg. 40).	Crane needs to be adequate for installation of Unit 8 TG as well as continued service to Unit 7 and ongoing maintenance in the Powerhouse.	Yes	There should be an additional assessment of the Unit 7 bridge crane and hoist for compatible parts for Unit 8 - Compatible parts should also be verified to ensure proper fit and function. This could impact schedule and cost.	2		NUH	2023-11-08	
8 Unit #8 Existing Draft Tube Gates embedded parts conditions	Assumption made that the existing embedded parts and sealing faces of the Unit #8 draft tube gates are within acceptable tolerances, properly aligned, and in good condition.	Misalignment of embedded parts and defective sealing faces could damage the new gate and seal, leading to unacceptable leakage.	Yes	Condition assessment with ROV that was provided visually indicated good condition, however it is not sufficient to fully assess condition.			AR PR	2024-09-04	
9 Unit #8 Existing pressure relief valve (PRV) outlet valve gate conditions.	Assumption made that the existing valve gate of Unit #8 PRV outlet is in acceptable condition and leakage, providing isolation for the fire pump suction pipe from the PRV outlet transition.	If the valve gate is not in good condition, replacement is required.	Yes	Condition of this gate could not be assessed from available visual condition assessment with ROV			AR PR	2024-09-04	
10 Intake and draft tube gate guides anchor design.	No secondary stage reinforcing will be considered in the design and all loads will be assumed to be carried by first and second stage anchors for all guides at intake - trashracks, maintenance gates, operational gates.	The quality of the tailrace water source (tailrace water/river) should be tested, as seal or other means to separate cooling water system and fire protection systems. A material upgrade in these system might be required.							
11 Tailrace water quality requirements for cooling water and fire protection system.	The quality of the fire protection water source (tailrace water/river) should be tested, as seal or other means to separate cooling water system and fire protection systems. A material upgrade in these system might be required.	The quality of the tailrace water/river not provided. Acceptable range of salt and other material to be determined.	Yes				AR PR	2024-09-04	
12 CVTs have sufficient extra burdens	B7-CVT and B8-CVT have sufficient extra burdens to be connected to G8 synchronizers.						AR AE	2024-02-28	
13 Existing differential relays have spare inputs	Existing B7 and B8 differential relays (existing 87B7 and 87B8) have spare inputs to connect to G8 line.						AR AE	2024-02-28	
14 No new workstation required	No new workstation is needed. Existing workstation has enough spare IO for G8 connections.						AR AE	2024-02-28	
15 AC Electrical Loads	Most of the rating of the loads being considered is based on Unit #7 single line diagrams. There are equipment being excluded that could be integrated into the existing system such as fire alarm & security other closely similar hydro power plants.						AR JP	2024-09-06	
16 DC Electrical Loads	Most of the rating of the loads being considered is based on Unit #7 single line diagrams and equipment in other closely similar hydro power plants.						AR JP	2024-09-06	
17 Spacing and availability for TS2 expansion	Required land for TS2 expansion on east side of existing station is available		Yes				AR BB	2024-09-06	
18 TS2 New Control Building Layout	Most of the dimensions of the equipment, cabinets and panels being considered are based on the existing ones in the existing control building.						AR JP	2024-09-06	
19 Addition of 230kV diameter	New 230kV diameter in TS2 for unit 8 connectivity is assumed to be similar to existing equipment configuration and NABCO Hydro design standards.						AR BB	2024-09-09	

No.	Topic	Issue / Risk Description	Risk Statement	Risk Rating PRE-TREATMENT (Likelihood X Consequence)		Mitigating actions	Risk Rating POST-TREATMENT (Likelihood X Consequence)		Target completion date	Person Responsible	Status	Topic	FEED Comments
				Likelihood	Consequence		Likelihood	Consequence					
1	Construction	Dust control issues	Dust control can become a major issue toward the end of the TG installation.	5	3	15	2	2	4				No reasonable clause is usually provided, therefore no one takes responsibility. Dust regimen required. Assign property and enforce.
2	Construction	Cement (cementitious materials) supply interruptions	Results in issues with availability and potential interruptions of delivery during construction and project structure delays.	4	3	12	2	2	4				e.g. "To avoid running out of cement in the middle of a pour, use of portable mitigations"
3	Construction	Weather related stoppages	Potential severe weather could delay deliveries, stop construction (storms, cold) or damages construction in progress.	5	4	20	5	2	10				
4	Construction	Temperature extremes (<3 to >33 °C)	Temperature extremes could lead to HSE issues and cost consideration delays if not anticipated and plans in place to mitigate	3	3	9	2	2	4				
5	Construction	Batch plant availability issues	Leads to potential breakdown, productivity, material supplies delivery, if dry mix from Grand Falls then access logistics)	5	3	15	3	2	6				Assumption batch plant on site. To be discussed during Constructability session.
6	Construction	Material quality and quantity availability issues (AR and permits)	Potentially leads to lack of aggregate sources for concrete, acceptability (advance notice) issues, delays in permits, and availability/potential, site permits, and routes, etc.	5	5	25	2	2	4				Considering prequalification process for aggregates.
7	Construction	Blasting works damaging structures	Could impact existing infrastructure structures under construction. Potentially resulting in additional cost/delays or causing environmental issues.	4	5	20	1	3	3				Limit with controlled blasting, monitoring in place during construction and ensure that structures to be respected. Consider blasting consultant. If close to unit, mechanical excavation suggested instead of controlled blasting.
8	Access/Site	Continued access to PH 2 for operation and maintenance during Construction	Continuation of Unit 8 Powerhouse could interfere with need for continued need to access Unit 1.	4	4	16	2	2	4				Access and site considerations to be included in FEED report and cost estimate.
9	Access/Site	Access across PH 1 during construction	Could cause delays in getting material and equipment to site for Unit 8 PH construction. Width is single lane on bridge and access road has cable tray in way restricting bridge equipment.	5	5	25	2	5	10				Access and site considerations to be included in FEED report and cost estimate.
10	Constructability	Unplanned maintenance work on U7	Interferes with construction	3	5	15	1	1	1				
11	Constructability	Most of equipment delivery to site from St. John's via single access road from Trans Canada Highway.	If there is poor management of the flow of goods and services from supplier(s) to the island could cause delays in receiving equipment and components thus increasing the work productivity impacting time and cost.	3	3	9	2	2	4				
12	Constructability	Critical major equipment / specialty transportation	Results in delays impacting time and cost	3	4	12	2	2	4				To be addressed also during Constructability session.
13	Constructability	Sequence of Construction not worked out in advance.	Lack of planning with respect to sequence of activities with constructability data to issues revealed during construction including rework which impacts schedule and cost.	4	4	16	2	3	6				Constructability and site considerations to be included in FEED report, cost estimate, and schedule.

No.	Topic	Issue / Risk Description	Risk Statement <i>"Concurrent Causes leads to Effect"</i>	Risk Rating PRE-TREATMENT (Likelihood X Consequence)			Mitigating actions			Risk Rating POST-TREATMENT (Likelihood X Consequences)			Target completion date	Person Responsible	Status	Topic	FEED Comments
				Likelihood	Consequence	Rating				Likelihood	Consequence	Rating					
14	Constructability	Traffic widening • economic analysis	If an economic analysis is not completed then schedule optimization opportunities may be missed. This could impact scope, time, and cost.	4	2	8	Include assessment in FEED study.			3	2	6					
15	Constructability	Electrical in powerhouse • safety by design	If designs do not consider operability and safety by design, hazards may be introduced into the systems. This could impact, safety, time, and cost.	4	3	12	1. Commissioning plans/procedures and or inspection test plans 2. Safety by Design, specific to the system. 3. Operational review			2	3	6					Consider NLI electrical safety design standards requirements. Compatibility integration of Unit 8 systems or controls with Unit 7 to be addressed.
16	Field Investigation	Geotechnical Investigations - large enough scope / unknown geotech conditions	Some and or all geotechnical work and investigations could take place as part of FEED and prior to an RFP for an EPCM contract. Unknown geotechnical conditions could impact time, and cost.	4	4	16	Towards the end of the FEED, to consider additional geotechnical investigations. Complete topographical survey and geotechnical investigation. Consider geophysical survey.			2	3	6					
17	Cost Estimate/Assumptions	Rebar, concrete, steel, etc • cost changes since 2016	The cost of steel and other materials would have increased since 2016 due to inflation. And any steel and other materials need to be re-estimated. This could impact cost.	3	3	9	1. Address early. 2. Scrutinize basis of estimate to confirm assumptions. 3. Obtain updated quotes for equipment and materials.			2	3	6					To be addressed in constructability and cost estimate process. NLI Investigating commodity pricing, and using financial tools/tactics.
18	Cost Estimate/Assumptions	Impact of 2018 estimate assumptions and exclusions	Cost estimate assumptions and exclusions for 2018 estimate may not be quality of the cost estimate. Without an understanding of the assumptions and exclusions, the control budget, contingency, and estimate may be underestimated. This could impact time and cost.	4	4	16	Scrutinize basis of estimate. Quantify items as much as possible. Included within either the control budget, contingency, and/or management reserve.			3	3	9					FEED consultant tasked with preparing 2018 estimate. Review assumptions, exclusions etc. are identified and are included in the contingency analysis.
19	Constructability	Construction Power	Construction power energy agreement should be established to capture costs and ensure power availability. This could not be understood and identified by contractor could cause issues and delays.	3	2	6	Define construction power availability including backup power. Include these items in the cost estimate.			2	2	4					
20	Constructability	Unit 8 construction could cause Unit 7 outages, SOP interaction.	The need to maintain Unit 7 operation during construction causes schedule delays.	4	4	16	Early identification and planning of required Unit 7 outages that are necessary for Unit 8 construction. Ensure there is early planning, communication and safety issues surrounding all interactions with operating plant			2	3	6					
21	Cost Estimate/Assumptions	If unit price contract and quantities vary could lead to cost increases	Several contracts will be awarded on a unit price model. Tender estimates could vary from actual quantities.	3	1	3	1. Field investigations to improve quantity estimates. 2. Contract pricing clauses to reflect unit price changes if quantities vary from tender estimates. 3. Implementing suitable change management procedures.			2	1	2					
22	Cost Estimate/Assumptions	Limited number of hydro turbines suppliers and their resources are high market demand	Physically results in higher costs, extended delivery schedule and possibly quality issues	4	5	20	1. Engage with suppliers in model testing scope as soon as possible 2. Enhanced oversight during design and manufacturing process. 3. Engage with suppliers to explore contracting models and risk allocation strategies.			3	3	9					Same as NLI 103
23	Construction	Welder Shortage	Results in extra cost and possibly schedule delay.	5	4	20	1. Fabricate as much as possible offsite. 2. Consider alternative material for penstock (fibreglass reinforced plastic eg) 3. Higher rates for welders			2	4	8					Plastic material (pipng) to be considered.
24	Cost Estimate/Assumptions	Labour Conditions	If labour availability is not known and labour rates are not included in estimate could lead to inaccurate estimates for project.	4	4	16	1. Using Bulkforce information provided by NLI, can help capture more accurately current and local labour conditions. 2. Survey key Contractors for their option.			2	3	6					Bulkforce information will be shared by NLI with AEC.
25	Construction	LDI Access	Access across LDI is only way to bring heavy equipment to make rax and has stability issues limiting max load amounts	4	3	12	Strengthening and upgrade of LD-1 to allow full access without restrictions to be completed before start of Unit 8 construction.			0	0	0					
26	Construction	HV Transformer not in separate specification for Construction.	Results in poor timing and schedule delay.	4	4	16	GSU transformer should have a separate specification for the entire scope of design, manufacture, FAT, shipping, installation, and SAT. It could be a separate Contract (similar to TG) or a sub-contract under the EOP Contract. Having full scope under one specification will reduce the risk of managing gaps.			1	1	1					To follow up with Electrical Lead
27	Construction	Existing capacity of PH2 crane	New Unit 8 may weigh more than the existing Unit 7 and the crane may not have sufficient capacity.	4	5	20	1. Include limitations of existing crane in Specification to ensure crane can handle max existing capacity. 2. Increase capacity of existing crane and superstructure to handle maximum Unit 8 lift. 3. Consider this as a separate scope. Units post project which may require upgrade to Unit 7 super structure.			1	1	1					

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28	Construction	Availability of PH2 crane for maintenance work required.	Could impact availability of Crane for U8 work and delay construction.	2	5	10	1. Hydro could accept this risk as low likelihood. 2. Boom truck in powerhouse could handle most of maintenance lifts unless significant issues. 3. Full mitigation if separate crane installed for Unit 8 construction.	1	1	1					
29	Construction	Spherical valve (supply access)	If TCO supplier not aware of requirement for a Spherical Valve and it may cause design changes and impact construction schedule.	2	4	8	1. Include in drawings and Specs provided to both TCO and Penstock Suppliers for information. 2. Design and supply of Valve with TCO or independent. 3. Include installation with Penstock installation scope. 4. TCO may be prohibitive and preclude decision to supply/install valve.	2	1	2					
30	Field Investigation	Geotech investigations - Skye behind powerhouse	The Service Bay added in 2016 design requires cutting into existing slope and accessing area with THT 1 switchyard.	4	3	12	1. Additional geotechnical investigations to fully understand composition in this area. 2. Advance design to include solution to support and stability in this area. 3. Sequence Construction to minimize the excavation.	2	1	2					
31	Constructability	Widening tailrace - Operations	Widening the tailrace will impact on Unit 7 operation and may have large impact if not properly planned and designed.	5	4	20	1. Design to minimize closure period. 2. Ensure contractor is aware of requirements and includes in their execution plan. 3. Ensure contractor is aware of requirements and includes in their execution plan.	2	3	6					
32	Constructability	Risk of Rainstorm/Water management/formation of slope	Heavy rain event during construction could cause erosion and damage to work underway.	5	2	10	1. Design allowances for large enough storm event. (1:50Y) 2. Allow amount in cost estimate for repairs. 3. Build the potential delay into the schedule.	5	1	5					
33	Construction	Relocation of underground cables from Powerhouse 2 to 1	If full information about location and make up of cables is not known, relocation work may result in extended shutdown of Unit 7.	3	3	9	1. NL Hydro to provide all information on existing cables, including composition and routing. 2. Initiate field investigation to confirm extent and location if required. 3. Relocation to be implemented at start of construction. coordinate with planned Unit 7 outage to minimize impact.	1	2	2					

*Items 24-33 were not assigned ratings during the Risk Workshop with NL Hydro. These are proposed ratings, determined by AtkinsRéalis.